Saturday 22 September 2001

BMJ

Lessons from Chernobyl

The world needs to improve its handling of international disasters

We have just passed the 15th anniversary of Chernobyl, the world's worst nuclear disaster. The explosion of the reactor at this nuclear power station in Belarus in 1986 released huge amounts of radioactive isotopes, about 10^{19} becquerels, and heavy fallout affected large areas of Belarus and northern Ukraine and a small part of Russia, with lesser amounts detected throughout the northern hemisphere. The response of international organisations to the need to study the long term health consequences of the explosion was at first uncoordinated and is still inadequate.

In 1990 the World Health Organization was given $20m (£14m) by Japan to investigate the health effects,[1] but expenditure was effectively controlled by one official, much of the money was spent inappropriately, and little of value resulted. Also in 1990 the International Atomic Energy Agency carried out a separate investigation. Though informed of cases of childhood thyroid cancer, it was generally reassuring about possible health consequences.[2] The United States and the European Union signed separate treaties with the governments involved, allowing them to investigate the health effects. Initially the European Union and WHO Europe played a major part in drawing attention to the increase in the incidence of childhood thyroid cancer[3–5] but then set up separate studies, as did the Sasakawa Memorial Health Foundation of Japan. Unesco, the International Red Cross, and several individual countries and organisations all became separately involved. Various research groups obtained thyroid tissue for study, sometimes without governmental agreement, and several groups unknowingly published results on the same tumours.

Eventually medical scientists representing the international thyroid associations took an initiative that led to some coordination. Thirteen years after the accident agreement was reached between the governments of Belarus, the Russian Federation, and Ukraine together with the European Union, the US (National Cancer Institute), the Sasakawa Memorial Health Foundation of Japan, and the WHO, and tumour banks were created. Through a coordinating centre in Cambridge DNA and RNA from fully documented tumours and normal tissues are now available to researchers.[6]

Many factors influenced the lack of cooperation between international organisations in the early years after Chernobyl. Some organisations were not happy to support studies for which they did not receive all the credit, and personality clashes played a part. WHO Geneva felt that it should control international coordination, but funding bodies were reluctant to cede control given the problems of the earlier WHO project. One major early difficulty was that many people predicted a small increase in the incidence of thyroid cancer, with a 10 year latent period, and they were reluctant to accept reports of a large increase four to five years after the explosion. In some cases the reluctance appeared to be an example of the general rule that the degree of proof needed to accept a causal link is strongly correlated with the vested interest of the individual or organisation in the outcome.

About 2000 cases of thyroid cancer have occurred in those exposed as children or adolescents to high levels of fallout from Chernobyl.[7–9] Fortunately there have so far been few deaths in these cases (E Demidchik, personal communication). Despite the dominant role of radioiodine in the initial fallout, it should not be assumed that there will be only thyroid effects. There are claims of increases in immune related diseases, birth defects, and a variety of cancers in the exposed population, but adequate studies are lacking. There is evidence of increased microsatellite instability in children born to exposed parents.[10] We do not know the long term effects of living in an environment contaminated with caesium-137, and there could be late radioiodine related effects, for example in the breast.

An international study of all long term health effects of exposure to Chernobyl fallout is needed, including confirmation of the original diagnoses, the role of ascertainment, and correlation of incidence with dosimetry. Such a study would cost only a fraction of the money the West is providing to allow Ukraine to close the last of the four Chernobyl reactors. Without adequate study there will be no authoritative assessment of all the consequences, allowing some groups to accept uncritically the highest claims made, while others can say there are no proved long term effects other than thyroid cancer.

The response to global warming provides another example of the correlation between degree of proof demanded and interest in the outcome. The appropriate question is not whether there is proof of cause and effect but whether there is a sufficient chance that human activity contributes to global warming to justify altering that activity. The answer is clearly yes, and a serious debate on the contribution that nuclear power can make to reducing global warming is needed which takes into account a comparison of all the health

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effects of nuclear and conventional power generation. It is made difficult both by exaggerated claims of the health consequences of Chernobyl and by the errors and cover ups of the nuclear industry itself.

Chernobyl is unlikely to be the last major nuclear disaster, and doubtless other events also requiring an international response will occur. International agencies faced considerable difficulties in dealing with an event of worldwide significance occurring in a world power with a history of scientific isolation, which itself underwent enormous political and economic change. To avoid a repeat of the confusion, planning must consider the potential conflict between the sovereignty of the country in which the event occurred and the importance to the rest of the world of ensuring an impartial investigation. For the health consequences the WHO, which has changed considerably since 1986, is the obvious lead agency. It might more appropriately facilitate rather than direct studies, which could be controlled by an independent group of experts selected by the relevant international scientific organisations and by countries directly involved or funding the studies.

We need to learn from Chernobyl and decide how to coordinate international involvement in the investigation of a major disaster in a way that benefits both the country most affected and the world as a whole. That way we can reduce the risk of future disasters and improve our ability to deal with their consequences when they do occur.

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DW's research has been supported by the European Commission, and he has attended conferences supported by the European Commission, WHO, and Sasakawa Foundation. He was involved in the creation of the Chernobyl Tumour Bank, supported by the above organisations and by the NCI and chairs its scientific project panel. He has not received any personal payment from any of the organisations mentioned in the editorial.

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40 years of methicillin resistant *Staphylococcus aureus*

MRSA is here to stay—but it can be controlled

Staphylococcus aureus is well adapted to the human body, capable of spreading from person to person, hiding in intracellular compartments,[1] and, most importantly, inducing various forms of human disease. During infection the bacterial cells produce a large variety of virulence factors, among which, for instance, are molecules that subtly interfere with the chemotaxis of neutrophils to the site of infection.[2] Adding to the complexity of the infectious process is the fact that the host also responds in a variety of ways immunologically, sometimes producing a certain degree of resistance to infection.[3] *S aureus* has remained among the top three clinically important pathogens over the past few decades, and a particular worry has been the rise of methicillin resistant strains.

The clinical need for an effective vaccine against *S aureus* is clear, but since infections caused by *S aureus* are complex and as yet largely undefined (from the perspective of both the pathogen and the host) strategies for developing vaccines are scarce.[4 5] In addition to the organism's incompletely understood biology, the acquisition of resistance to antibiotics has contributed to its pathoclinical potential. Methicillin resistant *S aureus* (MRSA) emerged rapidly after the introduction of this particular antibiotic, and the primary route of spread of the MRSA bacteria was soon shown to be through clonal dissemination. Although the gene inducing the resistance has been discovered in various genetic backgrounds, colonisation and infection were mainly caused by rapid spread, sometimes even between continents, of relatively small numbers of epidemic bacterial strains.[6] Therefore, our efforts should be directed towards elucidating the mechanisms underlying staphylococcal epidemicity, a phenomenon that remains largely unexplained. These studies should take environmental, human, and microbial characteristics into account.

Hospitals have to invest in maintaining an adequate level of microbiological hygiene—and in this respect combating MRSA has received much attention. The success of attempts to maintain microbiological hygiene depends heavily on antibiotic use in individual institutions. Studies have shown that the rate at which MRSA colonises and infects patients is significantly correlated with the amount and nature of the antibiotics prescribed in clinics.

At the turn of the millennium the conclusion has to be that Europe is still strongly divided. In southern and middle European countries the prevalence of MRSA in medical institutions is alarmingly high. The apparent attitude in these countries is that its spread is inevitable and preventive measures are inappropriate. However,

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